

MEMS Based Solutions for an Integrated and Miniaturized Multi-Spectrum Energy Harvesting and Conservation System: Energy Harvesting Technology Development for NASA

Introduction

As the mission of NASA shifts and expands, so too does the need for reliable, energy harvesting technology. Moving further out into the realms of space requires effective and efficient use of the energy present in this unique, and more often than not, harsh environment. From a broader perspective, this need for advancing the state-of-the-art in modern energy capture is shared by multiple missions outside of the many strategic goals of NASA's Space and Outer Planetary Missions. National defense systems, the electrical power grid system, the automotive industry sector, and the terrestrial-based alternative energy sector would all stand to benefit from improvements made to the power technology which is presently available.

The innovation of this proposal is in the development of three unique energy harvesting technologies utilizing our existing research strengths that will be of interest and utility to NASA applications and environmental conditions. By developing multiple technologies, NASA will be able to harvest energy from multiple waste energy sources, namely environmental vibrations, thermal energy, and solar flux. These devices will initially be developed separately, but all the while with an eye on the final integration into a single package at the end of Phase II. Since the research on these technologies has been ongoing, it is reasonable to develop an initial prototype of these technologies at the end of Phase I, with integration occurring in Phase II. The proposed integrated energy harvesting concept device is shown below in Figure 1.

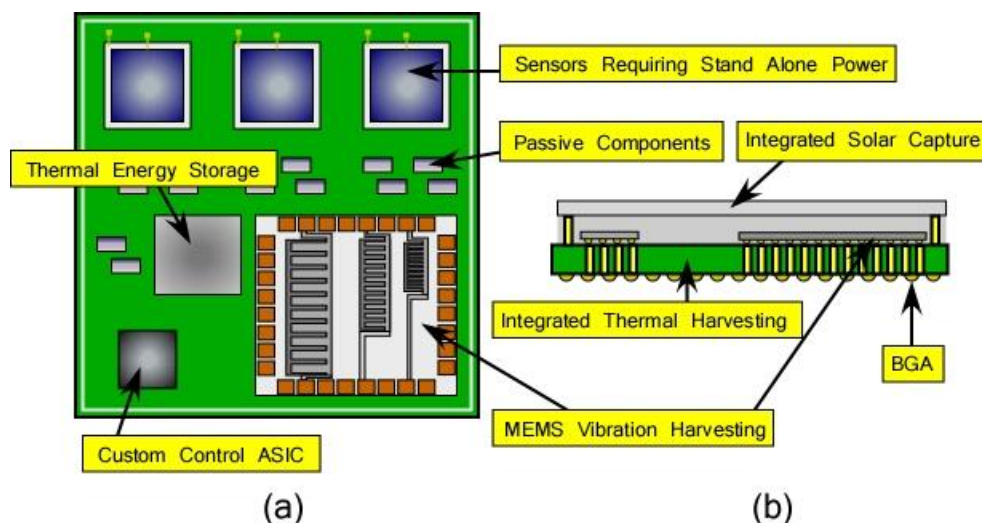


Figure 1: Integrated energy harvesting full system layout (a) and side profile view (b).

Radiance has partnered with Louisiana Tech University's (Tech) Institute for Micromanufacturing (IfM) to develop energy harvesting solutions for NASA related applications using their piezoelectric MEMS technologies, enhanced solar cell technology, and their thermal scavenging capabilities. Radiance has licensed these technologies for our applications in the military and commercial markets. The IfM is a full-scale MEMS fabrication facility from artwork design, mask making, lithography, deposition and etching, and packaging. Radiance has been collaborating with the IfM on similar projects since 2005. All Phase I objectives and deliverables were met on schedule, setting the stage for integration of the system and a successful Phase II Program if awarded.